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H4D DLAB D260 D714 D733 D753 D755 D762 D775

(56) Documents Cited
EP 0501345 A2   US 5631639 A   US 4028662 A
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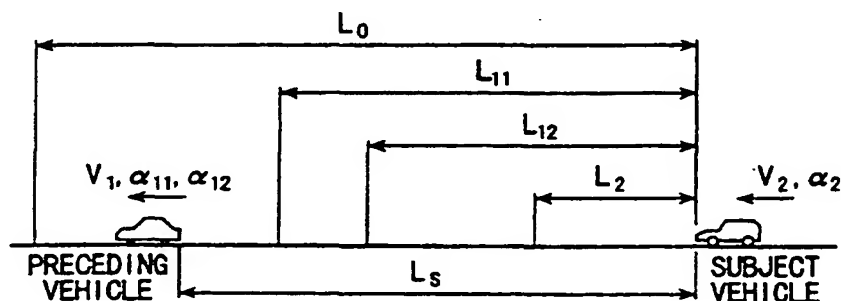UK CL (Edition O) G4Q QCE , H4D DLAB DLSX DLX DRPB DRPC
INT CL^6 G01S , G08G

(54) Collision avoidance system

(57)   In a vehicular drive assist system for warning a driver to pay attention to a preceding vehicle running ahead when a vehicle comes close to the preceding vehicle and the distance (L_s) between these two vehicles becomes smaller than a safe inter-vehicle distance (L_{c1}, L_{c2}), this safe inter-vehicle distance is automatically established in two stages according to traffic conditions. One stage is where the road is empty and another is where the road is crowded. Since the safe inter-vehicle distance at the crowded condition is established to be a smaller value than the one at the empty condition, when road is crowded, due to the shortened safe inter-vehicle distance, a warning is prevented from being issued so frequently.
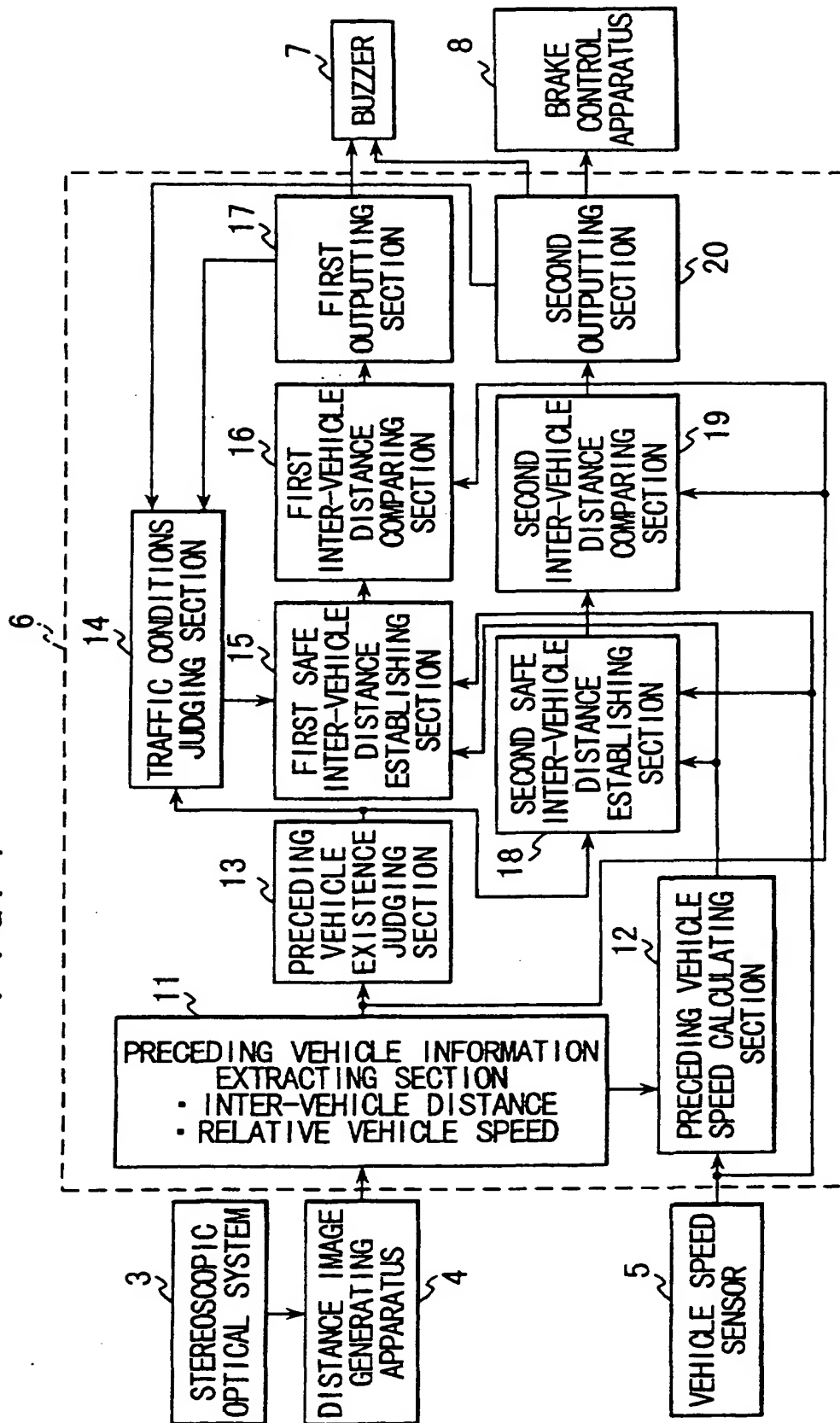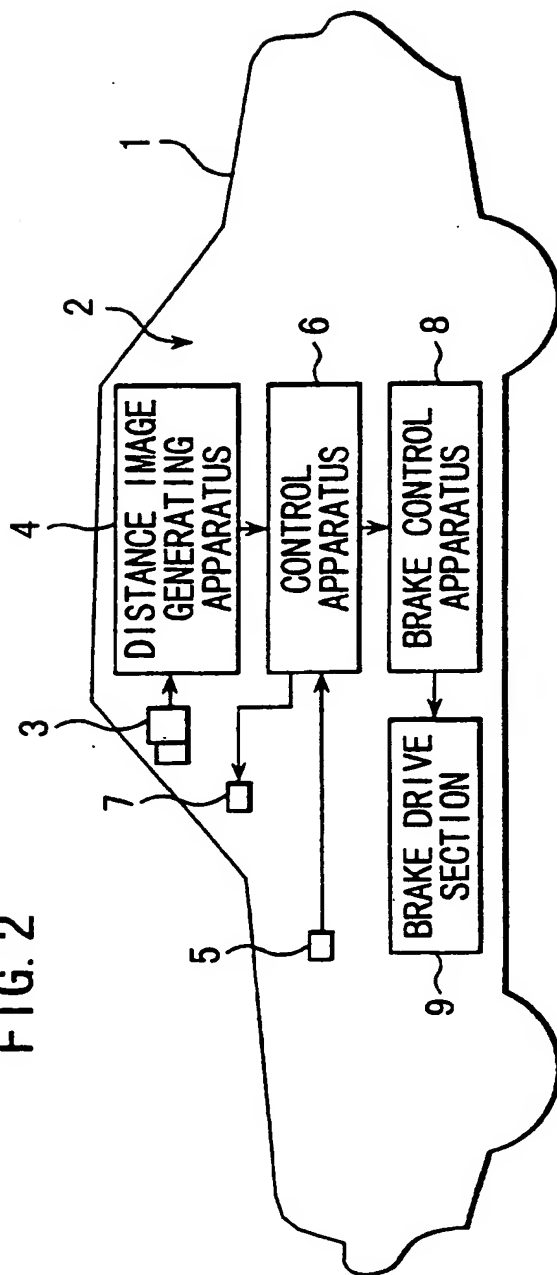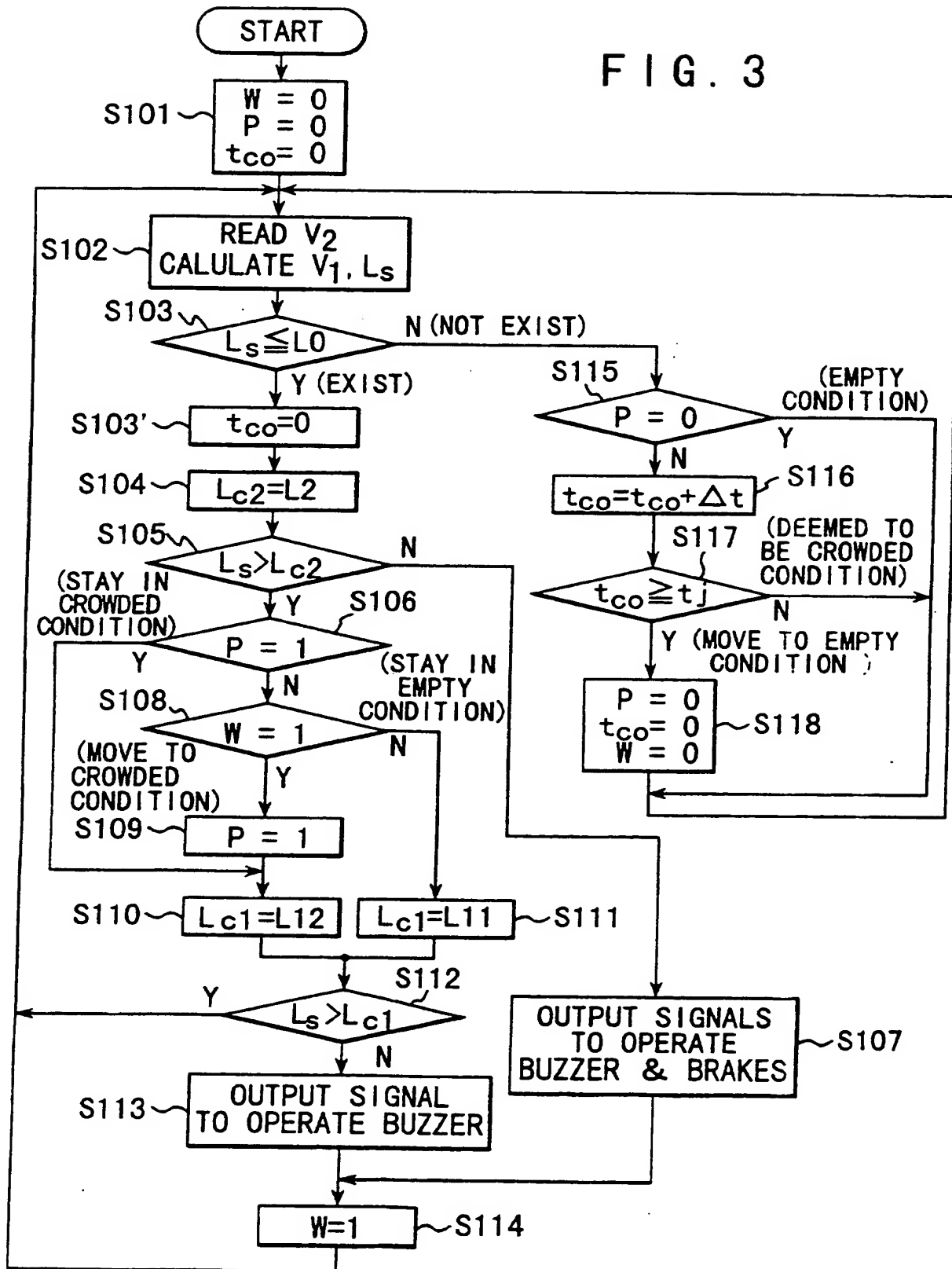
F I G . 4

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F I G. 1

BUZZER 7

BRAKE CONTROL APPARATUS 8

FIRST OUTPUTTING SECTION 17

SECOND OUTPUTTING SECTION 20

FIRST INTER-VEHICLE DISTANCE COMPARING SECTION 16

SECOND INTER-VEHICLE DISTANCE COMPARING SECTION 19

TRAFFIC CONDITIONS JUDGING SECTION 14

FIRST SAFE INTER-VEHICLE DISTANCE ESTABLISHING SECTION 15

SECOND SAFE INTER-VEHICLE DISTANCE ESTABLISHING SECTION 18

PRECEDING VEHICLE EXISTENCE JUDGING SECTION 13

6

PRECEDING VEHICLE INFORMATION EXTRACTING SECTION
• INTER-VEHICLE DISTANCE
• RELATIVE VEHICLE SPEED
11

PRECEDING VEHICLE SPEED CALCULATING SECTION 12

STEREOSCOPIC OPTICAL SYSTEM 3

DISTANCE IMAGE GENERATING APPARATUS 4

VEHICLE SPEED SENSOR 5

FIG. 2

F I G . 3

START

S101 — W = 0
P = 0
$t_{co}= 0$

S102 — READ V_2
CALULATE V_1, L_s

S103 — $L_s \leqq L0$ — N (NOT EXIST)

Y (EXIST)

S103' — $t_{co}=0$

S104 — $L_{c2}=L2$

S105 — $L_s>L_{c2}$ — N

(STAY IN CROWDED CONDITION)

Y   S106

P = 1   (STAY IN EMPTY CONDITION)

Y

S108 — W = 1 — N

(MOVE TO CROWDED CONDITION)

Y

S109 — P = 1

S110 — $L_{c1}=L12$ $L_{c1}=L11$ — S111

S112

Y — $L_s>L_{c1}$

N

S113 — OUTPUT SIGNAL TO OPERATE BUZZER

S115 — P = 0 — (EMPTY CONDITION)

Y

N

S116 — $t_{co}=t_{co}+\triangle t$

(DEEMED TO BE CROWDED CONDITION)

S117

$t_{co} \geqq t_j$ — N

Y (MOVE TO EMPTY CONDITION)

S118 — P = 0
$t_{co}= 0$
W = 0

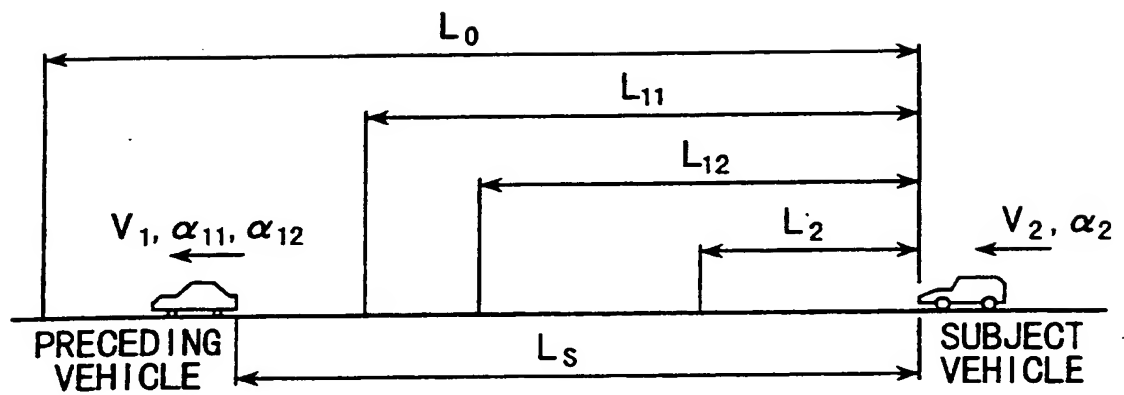S107 — OUTPUT SIGNALS TO OPERATE BUZZER & BRAKES

S114 — W=1

FIG. 4

DESCRIPTION

DRIVE ASSIST SYSTEM FOR VEHICLE

The present invention is directed to a drive assist system for a vehicle and more particularly to a drive assist system capable of assisting a driver's operation of the vehicle so as to maintain a proper distance between vehicles travelling in the same direction.

With an increase of the number of motor vehicles, frequent occurrence of traffic jams has also increased. In particular, such traffic jams very usually occur on the roads and highways in large cities and towns therearound. When a driver encounters traffic jams, it is necessary to continue to pay attention to a distance between the driver's own car and a car travelling ahead so as to avoid a collision with that preceding car. It is necessary to step on the brake pedal and the accelerator pedal in such traffic jams. This leads to stress and wearing on the driver which may increase the likelihood of a collision with the vehicle travelling ahead. Generally, it is difficult to maintain a proper distance between two cars especially if a driver's own car or the other vehicle changes speeds.

In order to save the driver from such stress or wearing, recently various approaches for safe driving have been attempted. One of these approaches is the development of an ADA (Active Drive Assist System) for positively assisting the driver's operation

of the vehicle under various traffic conditions. The ADA is a system which gives warnings to drivers, avoidance operations and the like when danger is imminent by estimating various possibilities of such a collision with the preceding vehicle, a contact with an obstacle, running off lanes and other troubles from surrounding information and running conditions of the driver's own vehicle. As an apparatus for collecting surrounding information, there is a known technique using a laser-beam radar. Recently, an ADA system employing cameras mounted on the vehicle has been developed. The ADA system is for recognizing road and traffic conditions as three-dimensional information with practically adequate accuracy by processing image information of the frontal scenery or objects taken by a plurality of cameras installed on the vehicle.

It is a most important function of the ADA to assist the vehicle driver so as to maintain a proper distance (hereinafter, referred to as an "inter-vehicle distance") between the vehicle and a preceding vehicle and to avoid a collision with the preceding vehicle. As an example of this kind of technology, Journal of The Society of Automotive Engineers of Japan Vol. 43, No. 2, 1989, an article "Rear-end Collision Warning System using Laser-beam for Heavy-duty Trucks" discloses a technology in which a vehicle speed of the preceding vehicle and a relative vehicle speed of the subject vehicle with respect to the preceding vehicle are calculated based on a vehicle speed of a subject vehicle and a distance between the subject vehicle and the preceding vehicle detected by a laser beam-radar apparatus, and when the distance between two vehicles comes within a safe inter-vehicle distance

calculated based on this relative vehicle speed, an alarm is sent out to a vehicle driver with two steps; a first step of the alarm is to warn the vehicle driver so as to make adjustment of the inter-vehicle distance and a second step of the alarm is to warn so as to apply brakes or turn the steering wheel.

The issuance timing of the first step alarm can be varied manually according to traffic conditions, driver's driving habits and the like.

However, this variable timing is rather troublesome when traffic conditions frequently change and the timing tends to be established at the position where the alarm is refrained, eventually the issuance of the alarm being alienated.

In view of the foregoing shortcoming, it is an object of the present invention to provide a vehicular drive assist system capable of automatically establishing a proper timing for the issuance of an alarm according to traffic conditions without a driver's operation of the drive assist system.

The drive assist system comprises inter-vehicle distance calculating means for detecting a preceding vehicle running ahead of a vehicle and for calculating an inter-vehicle distance between the vehicle and the preceding vehicle, vehicle speed calculating means for calculating a vehicle speed of the vehicle, preceding vehicle speed calculating means for calculating a vehicle speed of the preceding vehicle based on the inter-vehicle distance and the vehicle speed of the vehicle and collision preventing means for preventing a collision of the

vehicle with the preceding vehicle, traffic conditions judging means for judging a traffic condition, safe inter-vehicle distance establishing means for establishing a safe inter-vehicle distance according to the traffic condition, inter-vehicle distance comparing means for comparing the inter-vehicle distance with the safe inter-vehicle distance and for outputting a signal when the inter-vehicle distance becomes smaller than the safe inter-vehicle distance; and operating signal outputting means for outputting an operation signal to the collision preventing means based on the signal.

By way of example only, a specific embodiment of the present invention will now be described, with reference to the accompanying drawings, in which:-

Fig. 1 is a block diagram of an embodiment of vehicular drive assist system according to the present invention;

Fig. 2 is a schematic view of the vehicular drive assist system of Fig. 1;

Fig. 3 is a flowchart showing a flow of control of the vehicular drive assist system of Fig. 1; and

Fig. 4 is a view for explaining a safe inter-vehicle distance.

Referring now to Fig. 2, numeral 1 denotes a vehicle on which a drive assist system 2 having a collision preventing function is mounted. In this embodiment, only this collision preventing function of the drive assist system 2 will be described and therefore description of other functions which might be

involved in this system will be omitted.

The drive assist system 2 comprises a stereoscopic optical system 3 for imaging picture images in the vehicle running direction, a distance image generating apparatus 4 for generating distance images, a vehicle speed sensor 5 for detecting a vehicle speed V_2 of the vehicle 1, a control apparatus 6 for processing the distance images and the vehicle speed V_2, and for outputting a signal to a buzzer 7 and a brake control apparatus 8 for the collision preventing purpose.

The stereoscopic optical system 3 is composed of a pair of left and right CCD cameras mounted with a specified interval at the front ceiling of the passenger compartment.

The distance image generating apparatus 4 is mainly composed of an image processor in which distance images presenting three-dimensional distance distribution are formed over an entire image of a pair of stereoscopic pictures taken by the stereoscopic optical system 3 according to a principle of triangulation and is outputted to the control apparatus 6.

The control unit 6 is constituted by a microprocessor, in which the distance images sent from the distance image generating apparatus 4 are processed and information as needed is formed. In the control unit 6, the collision preventing control which will be described hereinafter is performed based on that information and the vehicle speed V_2 detected by the vehicle speed sensor 5 and the control signal is outputted to the buzzer 7 and the brake control apparatus 8, respectively.

The brake control apparatus 8 is connected with a brake drive section 9 constituted by a hydraulic unit including a

hydraulic pressure source, a pressure reducing valve, a pressure increasing valve and the like. Brake pressure is supplied from the brake drive section 9 to wheel cylinders (not shown) according to input signals from the brake control apparatus 8.

As shown in Fig. 1, the control apparatus 6 comprises a preceding vehicle information extracting section 11, a preceding vehicle speed calculating section 12, a preceding vehicle existence judging section 13, a traffic conditions judging section 14, a first safe inter-vehicle distance establishing section 15, a first inter-vehicle distance comparing section 16, a first outputting section 17, a second safe inter-vehicle distance establishing section 18, a second inter-vehicle distance comparing section 19 and a second outputting section 20.

The preceding vehicle information extracting section 11 functioning as an inter-vehicle calculating means makes image processings such as extracting a feature of a box-like object from distance image information inputted from the distance image generating apparatus 4 to identify a preceding vehicle from among objects in the picture images and outputs a distance L_s between the subject vehicle and the preceding vehicle to the preceding vehicle existence judging section 13, the first inter-vehicle distance comparing section 16 and the second inter-vehicle distance comparing section 19, respectively. In the case where a preceding vehicle does not exist within a detectable range, the inter-vehicle distance is established to be a large value such as 999 m and that value is outputted. Further, in the preceding vehicle information extracting section 11, a relative vehicle

speed between two vehicles is calculated based on the change of the inter-vehicle distance L_S versus time and outputted to the preceding vehicle speed calculating section 12.

In the preceding vehicle speed calculating section 12, a vehicle speed V_1 of the preceding vehicle is calculated based on the relative vehicle speed from the preceding vehicle information extracting section 11 and the vehicle speed V_2 detected by the vehicle speed sensor 5 of the subject vehicle and outputted to the first safe inter-vehicle distance establishing section 15 and the second safe inter-vehicle distance establishing section 18, respectively.

In the preceding vehicle existence judging section 13, it is judged whether or not a preceding vehicle exists based on the value of the inter-vehicle distance L_S derived from the preceding vehicle information extracting section 11 and the result of the judgment is outputted to the traffic conditions judging section 14 and the second safe inter-vehicle distance establishing section 18, respectively.

In the traffic conditions judging section 14 acting as a traffic conditions judging means, it is judged whether the traffic condition is a crowded condition or an empty (not crowded) condition and the result of the judgment is outputted to the first safe inter-vehicle distance establishing section 15. The crowded condition is defined as a period where the preceding vehicle exists within a predetermined range of distance L_0 after the buzzer 7 is operated by a signal from the first outputting section 17 or after both the buzzer 7 and the brake control apparatus 8 are operated by a signal from the second outputting section 20, or

a period where the preceding vehicle is out of the predetermined range of distance L_0 for a specified time t_j after the buzzer 7 or both the buzzer 7 and the brake control apparatus 8 are operated. All other conditions are defined as an empty condition.

In the first safe inter-vehicle distance establishing section 15 formed as a safe inter-vehicle distance establishing means, based on the result of judgment (crowded condition or empty condition) in the traffic conditions judging section 14, a first safe inter-vehicle distance L_{C1} which is a reference value for generating a first assist output is calculated and outputted to the first inter-vehicle distance comparing section 16. Here, the first assist output is an output for warning a vehicle driver to pay attention to the preceding vehicle. The first safe inter-vehicle distance L_{11} in the empty condition is calculated as follows:

$$L_{11} = V_1{}^2 / (2.0 \times \alpha_{11}) - V_2{}^2 / (2.0 \times \alpha_2)$$
$$+ T_\alpha \times V_2 + L_\alpha \quad \ldots\ldots\ldots \quad (1)$$

where α_{11} is a specified deceleration value of the preceding vehicle; α_2 is a specified deceleration value of the subject vehicle; T_α is a delay time of operation of the subject vehicle and L_α is a leeway distance after stop. Generally, α_{11} is established to be 0.3 G for example.

The term $V_1{}^2 / (2.0 \times \alpha_{11})$ expresses a stopping distance of the preceding vehicle, the term $V_2{}^2 / (2.0 \times \alpha_2)$ expresses a stopping distance of the subject vehicle and the term $T_\alpha \times V_2$ expresses a dead running distance.

The first safe inter-vehicle distance L_{12} in the crowded condition is calculated according to the following formula:

$$L_{12} = V_1{}^2 / (2.0 \times \alpha_{11}) - V_2{}^2 / (2.0 \times \alpha_2) + (T_\alpha - T_\beta) \times V_2$$

$$+ L_\alpha \quad \cdots \cdots \quad (2)$$

where T_β ($T_\beta < T_\alpha$) is a time which has been determined beforehand through experiments and the like so as to adjust the delay time of T_α in consideration of driver's raised power of attention due to the closer inter-vehicle distance than normally.

Because of this, the first safe inter-vehicle distance L_{12} in the crowded condition is established to be shorter than the first safe inter-vehicle distance L_{11} in the empty condition.

Thus, in the first safe inter-vehicle distance establishing section 15, since an appropriate first safe inter-vehicle distance L_{C1} is established automatically according to traffic conditions, it is not necessary for the vehicle driver to do a changeover operation every time the traffic condition varies.

In the first inter-vehicle distance comparing section 16 forming an inter-vehicle distance comparing means, the first safe inter-vehicle distance L_{S1} (in the actual control, L_{S1} is either L_{11} or L_{12}) established by the first safe inter-vehicle establishing section 15 is compared with the present inter-vehicle distance L_S and when the present inter-vehicle distance L_S becomes smaller than the first safe inter-vehicle distance L_{C1}, a signal is outputted to the first outputting section 17.

In the first outputting section 17 forming an operational signal outputting means, based on the signal from the first inter-vehicle comparing section 16, a signal is outputted to the buzzer 7 so as to operate the buzzer 7 and to the traffic conditions judging section 14, respectively.

In the second safe inter-vehicle distance establishing section 18, a safe inter-vehicle distance (second safe inter-vehicle distance L_{c2}) is calculated and outputted to the second inter-vehicle distance comparing section 19. This second safe inter-vehicle distance L_{c2} is employed as a reference value for generating a second assist output so as to urge the driver to take action to prevent a collision with the preceding vehicle and at the same time to apply brakes. The second safe inter-vehicle distance L_2 set in L_{c2} is calculated according to the following formula:

$$L_2 = V_1^2 / (2.0 \times \alpha_{12}) - V_2^2 / (2.0 \times \alpha_2)$$
$$+ T_\alpha \times V_2 + L_\alpha \quad \ldots\ldots\ldots \quad (3)$$

In the formula (3), α_{12} is a specified deceleration value determined so as not to collide with the preceding vehicle even when the preceding vehicle brakes hard. Here, α_{12} is established to be 0.5 G for example. Fig. 4 shows a relationship between the first safe inter-vehicle distance L_{c1} (L_{11} or L_{12}) established in the first safe inter-vehicle distance establishing section 15 and the second safe inter-vehicle distance L_{c2} (L_2) established in the second safe inter-vehicle distance establishing section 18.

Further, in the second inter-vehicle distance comparing section 19, the second safe inter-vehicle distance L_{c2} (L_2) established in the second safe inter-vehicle distance establishing section 18 is compared with the present inter-vehicle distance L_S and when the present inter-vehicle distance L_S becomes smaller than the second safe inter-vehicle distance L_{c2}, a signal is outputted to the second outputting section 20

and the traffic conditions judging section 14, respectively.

Then, in the second outputting section 20, based on the signal from the second inter-vehicle distance comparing section 19 a signal is outputted to the buzzer 7 so as to operate the buzzer 7 and at the same time to the brake control apparatus 8 so as to apply brakes. Further, the signal is sent also to the traffic conditions judging section 14.

Describing the control of the drive assist system thus constituted with reference to a flowchart shown in Fig. 3, at a step S101 (hereinafter, referred to as S number) a traffic conditions judging flag P, an assist output judging flag W and a timer count t_{co} are cleared ($P = 0$, $W = 0$ and $t_{co} = 0$), respectively. Then, at S102 a vehicle speed V_2 of the subject vehicle is read from the vehicle speed sensor 5 and an inter-vehicle distance L_s and a preceding vehicle speed V_1 are calculated in the preceding vehicle information extracting section 11 and in the preceding vehicle speed calculating section 12, respectively.

The traffic conditions judging flag P is a flag for indicating whether the subject vehicle runs under the empty condition or the crowded condition. When running under the empty condition, the flag P is set to be "0" and when under the crowded condition, the flag is set to be "1". Further, the drive assist output judging flag W is a flag for indicating that either the first assist output or the second assist output has been outputted. When neither the first assist output nor the second assist output has been outputted, the flag W is set to be "0" and when either of them has been outputted, it is set to be "1". Further, the timer count t_{co} indicates an accumulated time since the preceding

vehicle goes out of the specified range (distance L_0).

Then, the program goes to S103 where it is judged whether or not the preceding vehicle exists within the specified range (distance L_0). That is to say, if the inter-vehicle distance L_S is equal to or smaller than the specified range (distance L_0), it is judged that the preceding vehicle exists and then the program goes to S104 via S103'. If the inter-vehicle distance L_S is larger than the specified range (distance L_0), it is judged that the preceding vehicle does not exist and then the program goes to S115. This processing at S103 is the one performed in the preceding vehicle existence judging section 13. At S103', the accumulated time t_{co} is cleared because it is judged that the preceding vehicle exists.

When the program goes from S103 to S104 as a result of the judgment that the preceding vehicle exists, the second safe inter-vehicle distance L_2 is calculated according to the formula (3) in the second safe inter-vehicle distance establishing section 18 and set in the second inter-vehicle distance L_{c2} which will be a reference value for the second assist output. Then, the program goes to S105 where the established second safe inter-vehicle distance L_{c2} is compared with the present inter-vehicle distance L_S. If the inter-vehicle distance L_S is larger than the second safe inter-vehicle distance L_{c2} ($L_S > L_{c2}$), judging that the second assist is not needed, the program steps to S106 and if the inter-vehicle distance L_S is equal to or smaller than the second safe inter-vehicle distance L_{c2} ($L_S \le L_{c2}$), judging that the second assist is needed, the program steps to S107 where the second outputting section 20 outputs a signal

to the buzzer 7 and the brake control apparatus 8 so as to operate the buzzer and brakes, respectively. After that, the program goes to S114 where the assist output judging flag W is set to be 1 (W = 1) and then returns to S102.

When it is judged at S105 that the second assist is not needed and the program goes to S106, it is judged whether or not the traffic conditions judging flag P is set. If the flag is set (P = 1), it is judged that the crowded condition is held and the program skips to S110. If the flag is cleared (P = 0), the program goes to S108 where it is judged whether or not the assist output judging flag W is set.

In case where the assist output judging flag W is set (W = 1) at S108, judging that the vehicle comes in the crowded condition, the program goes to S109 where the traffic conditions judging flag P is set (P = 1) and then steps to S110. On the other hand, in case where the assist output judging flag W is cleared (W = 0), judging that the vehicle is in the empty condition, the program goes to S111.

When the program goes to S110 from S106 or S109, the first safe inter-vehicle distance L_{12} at the crowded condition is calculated according to the formula (2) and the result of calculation is set to L_{c1}. When the program goes to S111 from S108, the first safe inter-vehicle distance L_{11} at the empty condition is calculated according to the formula (1) and the result of calculation is set to L_{c1}.

After the first safe inter-vehicle distance L_{c1} is set at S110 or S111, the program goes to S112 where this first safe inter-vehicle distance L_{c1} is compared with the present

inter-vehicle distance L_s. If the inter-vehicle distance L_s is larger than the first safe inter-vehicle distance L_{c1} ($L_s > L_{c1}$), judging that the inter-vehicle distance is kept appropriate, the program returns to S102 and if the inter-vehicle distance L_s is equal to or smaller than the first safe inter-vehicle distance L_{c1} ($L_s \leq L_{c1}$), judging that the first assist for calling a driver's attention is needed, the program goes to S113 where the buzzer 7 is operated. Then, the program goes to S114 wherein the assist output judging flag W is set to be 1 ($W = 1$) and returns to S102.

On the other hand, when it is judged at S103 that the preceding vehicle does not exist, the program goes to S115 where it is judged whether or not the traffic conditions judging flag P is cleared. If the traffic conditions judging flag P is cleared ($P = 0$), judging that the vehicle is in the empty condition, the program returns to S102 and if the traffic conditions judging flag P is set ($P = 1$), the program goes to S116 wherein the timer count t_{co} is counted up by Δt.

Then, at S117 it is judged whether or not the timer count t_{co} exceeds a specified time t_j. If the timer count t_{co} does not reach the specified time t_j ($t_{co} < t_j$), the vehicle is deemed to be still in the jam condition and the program returns to S102. If the timer count t_{co} becomes equal or larger than the specified time t_j ($t_{co} \geq t_j$), it is judged that the vehicle is transferred to the empty condition and the program returns to S102 after clearing all flags and the timer count t_{co} ($P = 0$, $W = 0$ and $t_{co} = 0$) respectively at S118.

Processes from S106 to S109 and from S115 to S118 correspond to ones performed in the traffic conditions judging

section 14. Those processes include operating just the buzzer or operating both the buzzer and brakes when the inter-vehicle distance becomes smaller than the specified distance value which is variable according to the traffic conditions. Further, once the buzzer is operated, it is judged that the traffic condition is deemed as the crowded condition while the preceding vehicle exists within the specified range (distance L_0) or until the specified time t_j elapses after the preceding vehicle goes out of that specified range.

The preferred embodiment is constituted so that the first assist output is an output for operating a buzzer and the second assist output is an output for operating both the buzzer and brake control apparatus, however it may be constituted only by the first assist output, namely, only the output for operating buzzer.

Further, the buzzer may be replaced with other means such as a warning light or an oral warning.

Furthermore, the second assist output according to the embodiment of the present invention is constituted so as to output to both the buzzer and brake control apparatus, however this output may be directed only to the buzzer or only to the brake control apparatus.

In summary, according to the present invention, in the drive assist system constituted such that the buzzer is operated to warn the vehicle driver to pay attention to the preceding vehicle when the inter-vehicle distance becomes smaller than a safe inter-vehicle distance, this safe inter-vehicle distance is calculated and automatically established according to the

traffic conditions, either empty or crowded. Due to this variable safe inter-vehicle distance, when road is crowded, frequent operation of the buzzer, which can annoy the vehicle, can be prevented.

While the presently preferred embodiment of the present invention has been shown and described, it is to be understood that this disclosure is for the purpose of illustration and that various changes and modifications may be made without departing from the scope of the invention.

CLAIMS

1.   A drive assist system for a vehicle having inter-vehicle distance calculating means for detecting a preceding vehicle ahead of said vehicle and for calculating an inter-vehicle distance between said vehicle and said preceding vehicle, vehicle speed calculating means for calculating a vehicle speed of said vehicle, preceding vehicle speed calculating means for calculating a vehicle speed of said preceding vehicle based on said inter-vehicle distance and said vehicle speed of said vehicle and collision preventing means for preventing a collision of said vehicle with said preceding vehicle, comprising:

traffic conditions judging means for judging a traffic condition;

safe inter-vehicle distance establishing means for establishing a safe inter-vehicle distance according to said traffic condition;

inter-vehicle distance comparing means for comparing said inter-vehicle distance with said safe inter-vehicle distance and for outputting a signal when said inter-vehicle distance becomes smaller than said safe inter-vehicle distance; and

operating signal outputting means for outputting an operation signal to said collision preventing means based on said signal.

2.   A drive assist system as claimed in claim 1

wherein said traffic condition including at least two conditions, a crowded condition and an empty condition.

3. A drive assist system as claimed in claim 2, wherein said safe inter-vehicle distance is established to be relatively short when said traffic condition is judged to be said crowded condition and said safe inter-vehicle distance is established to be relatively long when said traffic condition is judged to be said empty condition.

4. A drive assist system as claimed in any of claims 1 to 3, wherein said crowded condition includes a condition that said preceding vehicle exists within a specified range of distance after said collision preventing means are operated and a condition that said preceding vehicle is out of said specified range of distance for a specified time after said collision preventing means are operated.

5. A drive assist system for a vehicle, substantially as herein described, with reference to, and as illustrated in, the accompanying drawings.

6. A vehicle comprising a drive assist system as claimed in any of the preceding claims.

The
Patent
Office

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Application No:	GB 9714370.5	**Examiner:**	Dr E P Plummer
Claims searched:	all	**Date of search:**	22 October 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

    UK Cl (Ed.O): H4D(DLAB,DLSX,DLX,DRPC,DRPB), G4Q(QCE)

      Int Cl (Ed.6): G01S, G08G

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	EP0501345A2 Mitsubishi	
A	US5631639 Nippondenso published 20.5.97 but equivalent to DE19514654 published 26.10.95	
A	US4028662 Young	
A	New Scientist 15 August 1985 page 27	